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SERIAL NUMBERS HIGHER THAN 431

MODEL 304
PRESELECTOR

CUSHMAN ELECTRONICS, INC.
166 San Lazaro Avenue
Sunnyvale, Cal. 94086
408—739-6760

5601-0011-1

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We sincerely pledge our immediate and fullest cooperation
to all users of our precision electronic instruments.

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CUSHMAN ELECTRONICS, INC.
166 San Lazaro Avenue
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SECTION 1

GENERAL DESCRIPTION

The Model 304 Preselector is designed to increase the sensitivity of the Cushman Models CE-3 and CE-7 FM Communications Monitors. A conversion kit is available to permit use of the Model 304 with the Model CE-2B FM Communications Monitor.

When used with the CE-3 and CE-7, the Preselector is inserted through an opening in the front panel of the Monitor. All electrical connections except the RF input, are made by a preselector rear-panel plug which mates with a receptacle in the Monitor. The RF input, normally from an antenna, is applied through the ANT. connector on the front panel.

The kit for adapting the Preselector to the Model CE-2B includes a cabinet and two cables to make the electrical connections. Also furnished is a printed-circuit board that must be installed in the CE-2B to attenuate the IF signal to permit switching.

The Model 304 accepts a signal in a frequency range of from 25 to 50 MHz and converts it to a 10 MHz IF signal when the received signal has the exact frequency that was dialed-in on the Monitor. The other input (at P2) for this frequency conversion comes from the Local Oscillator (LO) of the Communications Monitor which is precisely set to produce a 10 MHz signal when the received signal is "on frequency". Any drift of a transmitter signal from its assigned frequency will be represented by an equal change (from 10 MHz) in the Preselector output frequency.

A switch on the preselector front panel permits a choice of narrow-band IF, to reduce adjacent channel interference when necessary, or a normal IF bandwidth when the full spectrum of the received signal is desired. An external d-c voltmeter can be connected to the AGC VOLTAGE jack to indicate relative signal strength and proper tuning. Because the AGC voltage is a function of received-signal strength, measuring and recording this voltage makes it possible to detect changes in the signal strength from remote transmitters over extended periods. The change in AGC voltage for a change in input-signal strength is greatest when the received-signal level is just above that required to turn on the Monitor's SIGNAL LEVEL light. At this level a 3-db signal-level loss can be detected.

CAUTION

■ *Signal levels in excess of 0.5 vac may damage the input stage. When a Monitor is directly connected to a transceiver (via a Model 304) the transmitter SHOULD NEVER be keyed.*

Frequency Range	25 to 50 MHz
Sensitivity	Less than 20 microvolts
Maximum Input-Signal Level	0.5 volts
Input Impedance	50 ohms (nominal)
Output Frequency (IF to Monitor)	10 MHz
IF 3-db Bandwidth: SELECTIVITY; NORMAL	80 kHz
SELECTIVITY; SHARP	20 kHz
AGC Dynamic Range	Greater than 80 db
Power Requirements	Obtained from Monitor
Dimensions	5 ½ in. high, 4 in. wide, 10 in. deep
Net Weight	5 lbs.
Shipping Weight	7 lbs.

Table 1-1, Specifications

SECTION 2

OPERATING INSTRUCTIONS

2.1 General

The functions of the front-panel controls and connectors shown in Figure 2-1 are given in Table 2-1. Two sets of operating Instructions are given: 1) for the Model 304 when used with the CE-3 or CE-7 and 2) for the Model 304 when it is used with the CE-2B.

NOTE

- *Although the Model 304 has been most carefully designed to eliminate the pick up of interference, a powerful transmitter in the immediate vicinity may make Preselector operation over its entire frequency range impossible; even with the SELECTIVITY switch in the SHARP position. To monitor effectively, operations should be suspended until the interfering transmitter is off the air.*

Figure 2-1. Model 304 Preselector, Front Panel

2.2 Operation with CE-3 and CE-7

a. Insert the Preselector through the right-hand opening in the Monitor front panel and turn the LOCK on the preselector front panel clockwise until finger tight.

b. Connect a 50-ohm cable from the antenna to the preselector ANT. connector.

NOTE

- *When the telescoping antenna furnished with the Monitor is used with the Model 304, the increased sensitivity may result in pick-up of sufficient radiation from the Monitor itself to light the SIGNAL LEVEL indicator. An external antenna is therefore recommended.*

c. (Optional) Connect a d-c voltmeter (sensitivity at least 20,000 ohm per volt) to the AGC VOLTAGE jack and set the meter to the lowest range that will accommodate a voltage swing of from -2 to -6 volts. Use of a voltmeter is a convenience not a necessity.

d. Turn the preselector SELECTIVITY switch to NORMAL.

NOTE

- *When the SELECTIVITY switch is in the NORMAL position the entire content of the received signal is delivered to the CE-3 or CE-7. To make frequency measurements when there is adjacent-channel interference, this switch should be turned to SHARP. In the SHARP position, the IF bandwidth is narrowed to the extent that the absolute accuracy of the deviation displayed on the Deviation Meter or the Oscilloscope may be slightly degraded. The SHARP position should, therefore be used only when absolutely necessary.*

e. Place the Monitor in the FREQ.-DEV.MEASURE mode and dial-in the nominal frequency of the signal that is to be measured.

f. Turn the preselector tuning dial to the nominal frequency of the signal to be measured and carefully adjust this dial until a maximum reading on the voltmeter (connected in step c) is obtained. If a voltmeter was not connected, tune for the frequency at which the monitor SIGNAL LEVEL light just comes on.

g. Proceeed with monitoring operations as described in the CE-3 or CE-7 instruction manual.

Device	Function
SELECTIVITY switch	
In SHARP	A crystal filter reduces IF bandwidth to 20 kHz.
In NORMAL	IF bandwidth is 80 kHz.
Tuning Dial	Indicates approximate frequency (in MHz) to which the Preselector is tuned.
LOCK knob	Fastens Model 304 into position in the Monitor.
AGC VOLTAGE connector	Makes AGC voltage available to external voltmeter.
ANT. connector	UHF-type connector for 50-ohm antenna coax.

Table 2-1. Front Panel Controls and Connectors

2.3 Operation with CE-2B

(It is assumed that the printed circuit board furnished as part of the conversion kit has been installed in the CE-2B as per the instructions furnished with the kit)

a. Insert the Model 304 into the cabinet furnished with the conversion kit.

b. Connect one coaxial cable from the cabinet to the RF IN/SIG. OUT connector on the CE-2B.

c. Connect the other cable from the cabinet to the accessory receptacle on the side of the CE-2B.

d. Connect a 50-ohm cable from the antenna to the preselector ANT. connector.

e. (Optional) Connect a d-c voltmeter (sensitivity at least 20,000 ohm per volt) to the preselector AGC VOLTAGE jack and set the meter to the lowest range that will accommodate a swing of from -2 to -6 volts. Use of a voltmeter is a convenience not a necessity.

f. Turn the preselector SELECTIVITY switch to NORMAL.

NOTE

■ *When the SELECTIVITY switch is in the NORMAL position the entire content of the received signal is delivered to the CE-3 or CE-7. To make frequency measurements when there is adjacent channel interference, this switch should be turned to SHARP. In the SHARP position, the IF bandwidth is narrowed to the extent that the absolute accuracy of the deviation displayed on the Deviation Meter or the Oscilloscope may be slightly degraded. The SHARP position should, therefore be used only when absolutely necessary.*

g. Place the CE-2B in the FREQ.-DEV. MEASURE mode, and dial-in the nominal frequency of the signal that is to be measured.

h. Turn the preselector tuning dial to the nominal frequency of the signal to be measured and carefully adjust this dial until a maximum reading on the voltmeter (connected in step e) is obtained. If a voltmeter was not connected, tune for the frequency at which the monitor SIGNAL LEVEL light just comes on.

i. Proceed with monitoring operations as described in the CE-3 or CE-7 instruction manual.

SECTION 3

CIRCUIT DESCRIPTION

3.1 General

Figure 3-1 is a block diagram of the Model 304 Preselector. The signal that is to be measured for frequency is fed from the antenna through the tuned RF amplifier to one input of mixer Q3. Two signals are supplied by the monitor: one at a fixed frequency of 430 MHz, and the other at a frequency in the range of from 465 to 480 MHz as determined by the frequency selected on the Monitor. The fixed frequency is subtracted from the selected frequency in the LO mixer (CR1) to produce the LO input for mixer Q3, an input that is 10 MHz displaced from the frequency of the received signal. Thus, the output of mixer Q3 is exactly 10.000MHz if the received signal frequency is precisely the same as the frequency selected on the Monitor.

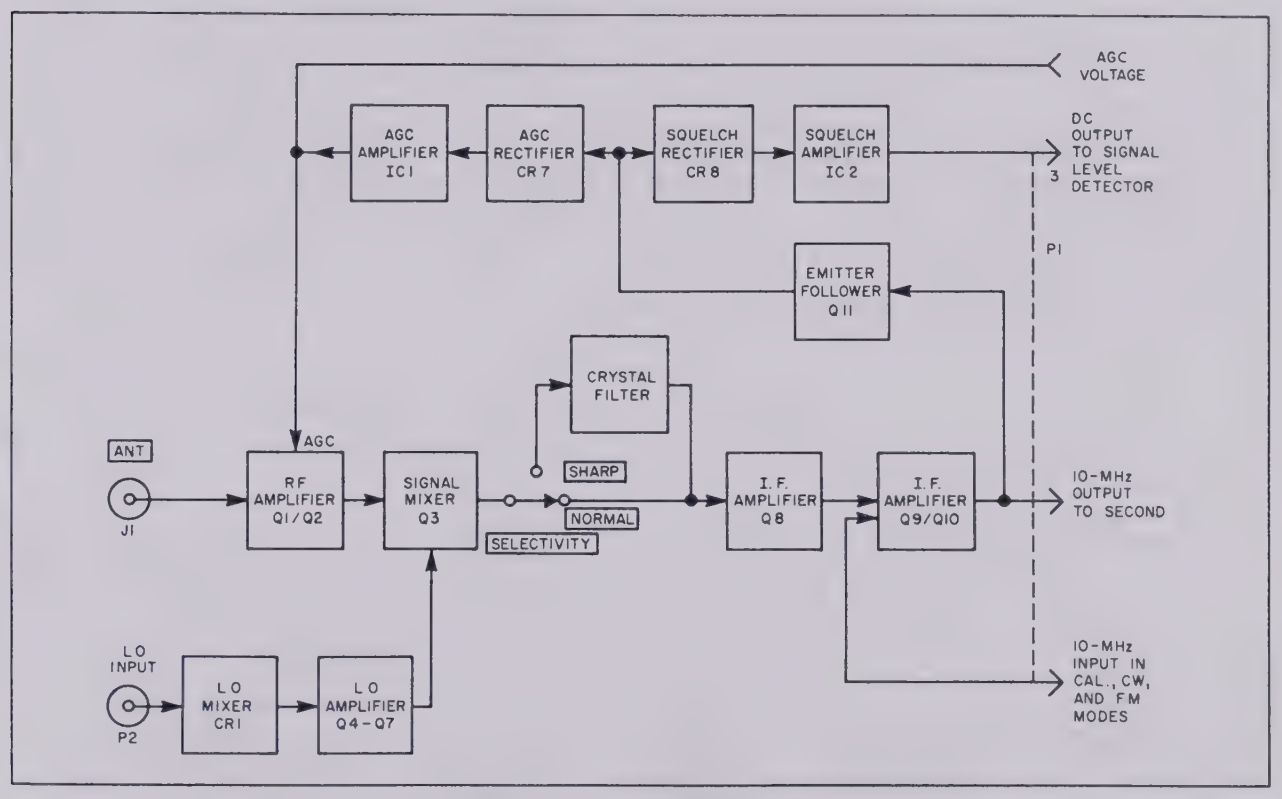


Figure 3-1, Model 304 Block Diagram

Dialed-In Frequency (f_{in})	Local Oscillator Input		LO Mixer Output $f_{LO} = (f_v - f_f)$	Signal Mixer Output $f_{IF} = f_{LO} - f_{in}$
	Fixed Freq. (f_f)	Variable Frequency (f_v)		
25.000 - 29.999	430	465.000 - 469.999	35.000 - 39.999	10.000
30.000 - 39.999	430	470.000 - 479.999	40.000 - 49.999	10.000
40.000 - 49.999	430	460.000 - 469.999	30.000 - 39.999	10.000

Notes:
1. *All frequencies are in MHz.*
2. *The last four digits of the dialed-in frequency are the same as the last four digits of the LO variable-frequency input.*
3. *As shown in the table, f_{LO} is sometimes 10 MHz higher than f_{in} and sometimes 10 MHz lower. This is compensated for by the FREQUENCY meter reversing relay in the CE-3 (see Section 4.3.2 of the CE-3 manual).*

Table 3-1. Frequency Relationships — Model 304 with CE-3

3.2 Frequency Relationships in CE-3

Table 3-1 summarizes the frequency relationships in the mixing process that takes place when the Preselector is used with the CE-3. As an example, assume that the transmitter to be monitored is assigned a frequency of 34.567 MHz. When this frequency (fin) is dialed-in on he CE-3, the resulting variable-frequency LO input (f_V) to the Preselector will be 474.567 MHz (430 + 10 + 34.567). This frequency is combined with the fixed-frequency LO input (f_f) of 430 MHz in the LO mixer to roduce a difference frequency of 44.567 MHz (f_{LO}). This frequency is, in turn, combined with the incoming signal frequency (34.567 MHz, if the transmitter is on frequency) in mixer Q3 to produce a Preselector output of 10.000 MHz. If the transmitter frequency were 1 kHz too high (34 568 MHz), the IF frequency would be 44.567 – 34.568 = 9.999 MHz instead of 10.000 MHz, and this difference would be indicated on the FREQUENCY meter of the CE-3.

Dialed-In Frequency (f_{in})	LO Input (f_{LO})	Signal Mixer Output $f_{IF} = f_{LO} - f_{in}$
25.000 - 29.999	35.000 - 39.999	10.000
30.000 - 39.999	40.000 - 49.999	10.000
40.000 - 49.999	30.000 - 39.999	10.000

Notes: 1. *All Frequencies are in MHz.*
2. *The last four digits of the dialed-in frequency are the same as the last four digits of the LO input.*
3. *As shown in the table, f_{LO} is sometimes 10 MHz higher than f_{in} and sometimes 10 MHz lower. This is compensated for by the FREQUENCY meter reversing relay in the CE-2B (see Section 4.2.5 of the CE-2B manual).*

Table 3-2. Frequency Relationships – Model 304 with CE-2B

3.3 Frequency Relationships in CE-2B

When the Preselector is used with the CE-2B, the LO input required by mixer Q3 is furnished directly by the CE-2B. A single variable-frequency LO input, 10 MHz higher than the dialed-in frequency is fed through mixer CR1 and the LO amplifier to Q3. Otherwise the operation is the same as in the CE-3. Table 3-2 summarizes these frequency relationships.

3.4 Frequency Relationships in CE-7

When the Preselector is used with the CE-7, the LO input to the Preselector is 10 MHz away from the frequency selected by means of the CARRIER FREQUENCY SELECTOR of the CE-7. This frequency is generated in the CE-7 by an oscillator which operates with crystals that have fundamental frequencies between 6.2 and 9.4 MHz. A tunable harmonic amplifier and a step recovery diode raise this range to from 18 to 1150 MHz. The 10-MHz signal required in the CW, CAL and FM operating mode is also generated by a crystal oscillator.

3.5 Signal Path

In the NORMAL position of the SELECTIVITY switch, the 10-MHz output of mixer Q3 is fed directly to IF amplifiers Q8, Q9, and Q10 and from there to the Monitor. The bandwidth of this signal is the full bandwidth of the IF amplifier - approximately 80 kHz. In the SHARP position of the SELECTIVITY switch, the mixer output is first passed through a crystal filter, which reduces the bandwidth to about 20 kHz.

The output of the IF amplifiers is also fed through emitter follower Q11 to the AGC rectifier, CR7, and to the squelch rectifier, CR8, which produce voltages proportional to the amplitude of the IF signal. The output of CR7 is amplified by IC1, the AGC amplifier and applied to the two RF amplifier stages, Q1 and Q2, as an AGC voltage. This voltage is also available at the front-panel ACG VOLTAGE jack and can be used to provide an indication of input signal level. The reference level of d-c amplifier IC1 is controlled by potentiometer R55 (See section 4 for adjustment procedure).

Similarly, the output of CR8 is applied to squelch amplifier IC2, the output of which drives the SIGNAL LEVEL light on the Monitor front panel. The reference level of d-c amplifier IC2 is controlled by potentiometer R72 (See section 4 for adjustment procedure).

In the CW, CAL, and FM operating modes of all three Monitors a 10-MHz signal from the Monitor must be applied to the Preselector IF channel, at the input of Q9.

As shown in the schematic diagram (Figure 5-2) the received signal, which enters at the front-panel ANT. connector is applied to one gate of MOS field-effect transistor, Q1, in the first RF amplifier stage. This input circuit is tuned by L1, C1, and C2; L1 and C2 are factory-adjusted trimmers and C1 is the main tuning capacitor. The output of Q1 is amplified by Q2 and applied to one gate of mixer Q3.

The LO input from the Monitor is applied to the Preselector through P2 and hence to LO mixer CR1. When the input comes from a CE-3, the two input frequencies are mixed in CR1*, and the difference frequency is fed via the LO amplifier stages Q4, Q5, Q6, and Q7 to the other gate of mixer Q3. The four-stage LO amplifier is untuned and negative feedback is used to improve stability.

The output of mixer Q3 is fixed-tuned to 10 MHz by L7 and C20, and passed through the crystal filter or around it, depending on the setting of the front-panel SELECTIVITY switch. The 10 MHz signal, either wide-band or narrow-band, is amplified by Q8, Q9 and Q10 all of which are fixed-tuned. Thermister R26 is for temperature compensation of the gain. In the CAL., CW, and FM mode of operation, the 10-MHz signal for the IF channel is fed from pin 1 of P1 to the base of Q9.

The 10-MHz output at the collector of Q10 goes to the monitor via pin 7 of P1, as well as to the base of emitter folower Q11. The output of Q11 is rectified by CR8 and applied to one of the differential amplifiers in integrated circuit, IC2. Input to the other differential amplifier in IC2 is a d-c voltage from potentiometer R72 The difference output at pin 6 of IC2 is the squelch voltage which is used (via pin 3 of P1) to drive the signal level detector in the Monitor. A similar voltage furnishes an AGC voltage for Q1, Q2 and the front-panel AGC VOLTAGE jack.

*When the LO input is furnished by a CE-2B or a CE-7, the single frequency is fed through CR1 to Q4.

SECTION 4

ADJUSTMENTS

4.1 AGC Voltage Adjustment

To adjust the AGC voltage, operate the Model 304 with a CE-3, CE-7, or CE-2B, and proceed as follows:

a. Connect the output of a signal generator to the ANT. connector of the Preselector, and adjust the signal generator for an output of 100 millivolts at 40 MHz. When the Preselector is used with a CE-7, select a frequency for which the CE-7 has been equipped with a crystal, preferably near 40 MHz.

b. Turn the SELECTIVITY switch to NORMAL.

c. On the Monitor, turn the switch to FREQ.-DEV.MEASURE, and select the frequency to which the signal generator was set in step a.

d. Connect a voltmeter with a sensitivity of at least 20,000 ohm per volt to the AGC VOLTAGE jack and tune the Preselector for maximum AGC voltage

e. Adjust AGC control R55 (see Figure 4-1 for location) to produce 150 millivolts at pin 7 of the Preselector plug-in connector, when measured with a high-impedance RF voltmeter.

4.2 Signal-Level Indicator Adjustment

The signal level at which the Monitor SIGNAL LEVEL indicator lights, is adjusted by means of potentiometer R72 (See Figure 4-2 for location) when the Preselector is used with either a CE-3 or a CE-7. When the Model 304 is used with a CE-2B, the SIGNAL LEVEL is predetermined by installation of the attenuator board that is provided with the CE-2B conversion kit. Potentiometer R72 in the Model 304 will have no effect whatsoever.

Adjustment of the signal level in the CE-3 and the CE-7 is performed as follows:

a. Connect the output of a signal generator to the ANT. connector of the Preselector and adjust the signal generator output for a medium level at 40 MHz or, when a CE-7 is used, a frequency for which there is a crystal available, preferably near 40 MHz

b. Turn the SELECTIVITY switch to NORMAL.

c. On the Monitor, place the function switch in the FREQ.-DEV.MEASURE position and select the frequency to which the signal generator was set in step a.

d. Connect a d-c voltmeter with a sensitivity of at least 20,000 ohm per volt to the AGC VOLTAGE jack and tune the Preselector for a maximum indication on the meter.

e. Adjust the signal generator so that there is 60 millivolts at pin 7 of the Preselector plug-in connector, when measured with a high impedance RF voltmeter.

f. Starting fully counterclockwise, turn the squelch potentiometer (R72) slowly clockwise until the SIGNAL LEVEL light just comes on.

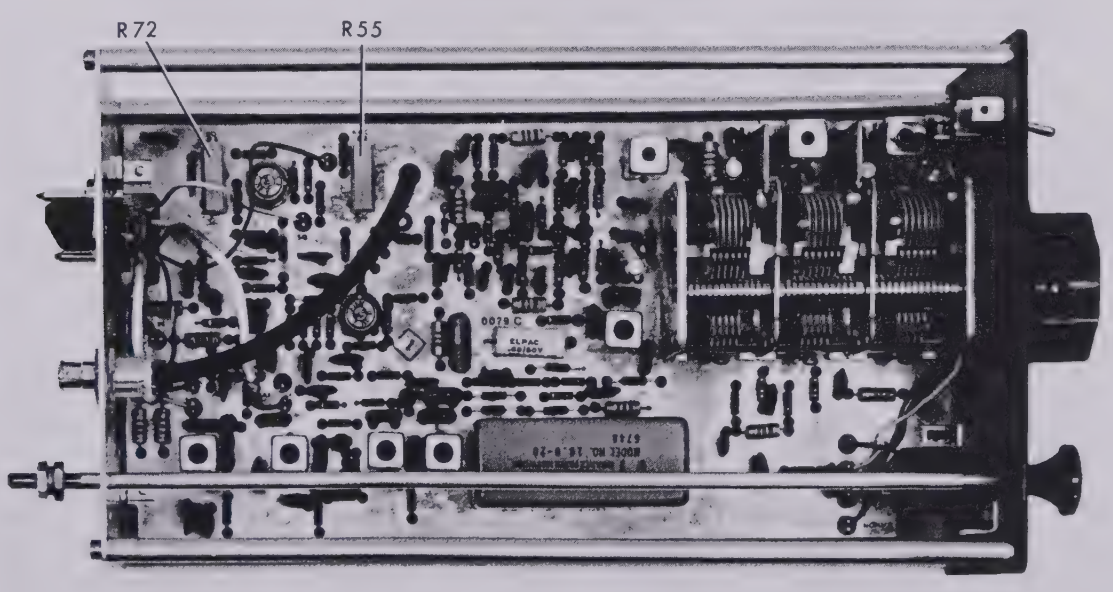


Figure 4-1. Model 304 Preselector, Interior View

SECTION 5

SCHEMATICS AND PARTS' LOCATIONS

5.1 Reference Designators

A	assembly
B	board
C	capacitor
CR	diode
DS	device signaling (lamp)
E	misc. electronic part
F	fuse
FIL	filter
J	jack
K	relay
L	inductor, RF, choke
M	meter
CH	chassis
FP	front panel
RP	rear panel
P	plug
Q	transistor
R	resistor
Hz	hertz
RT	thermistor
SW	switch
T	transformer
TB	terminal board
TP	test point
V	vacuum & display tubes
X	crystal
SCR	silicon controlled rectifier
LS	speaker

5.2 Abbreviations

Amp	amperes
AFC	automatic frequency control
Ampl	amplifier
BP	bandpass
CCW	counter-clockwise
Cer	ceramic
Coef	coefficient
Com	common
Comp	composition
Conn	connector
CRT	cathode-ray tube
CW	clockwise
DepC	deposited carbon
Electro	electrolytic
Encap	encapsulated
EXT	external
F	farads
Ge	germanium
GRD	ground(ed)
H	henries
IF	intermediate frequency
Incd	incandescent
INT	internal
k	kilo - 1000
Lin	linear
Log	logarithmic
LPF	low pass filter
m	milli - 10^{-3}
M	meg - 10^{6}
MFLM	metal film
MFR	manufacturer
Minat	miniature
Mom	momentary
My	''mylar''
N	nano 10^{-9}
NC	not connected
N/C	normally closed
N/O	normally open
NPO	negative positive zero
NRFR	not recommended for field replacement
P	peak
PC	printed circuit
pF	picofarads - 10^{-12} farads
PIV	peak inverse voltage
P/O	part of
Poly	polystyrene or polyester
Porc	porcelain
Pos	position(s)
Pot	potentiometer
P/P	peak-to-peak
Rect	rectifier
RF	radio frequency
S-B	slow-blow
Semi	semiconductor
Si	silicon
Ta	tantalum
Tog	toggle
Tol	tolerance
Trim	trimmer
TYP	typical
μ	micro - 10^{-6}
V	volts
Var	variable
VDCW	dc working volts
W/	with
W	watts
ww	wirewound
W/O	without

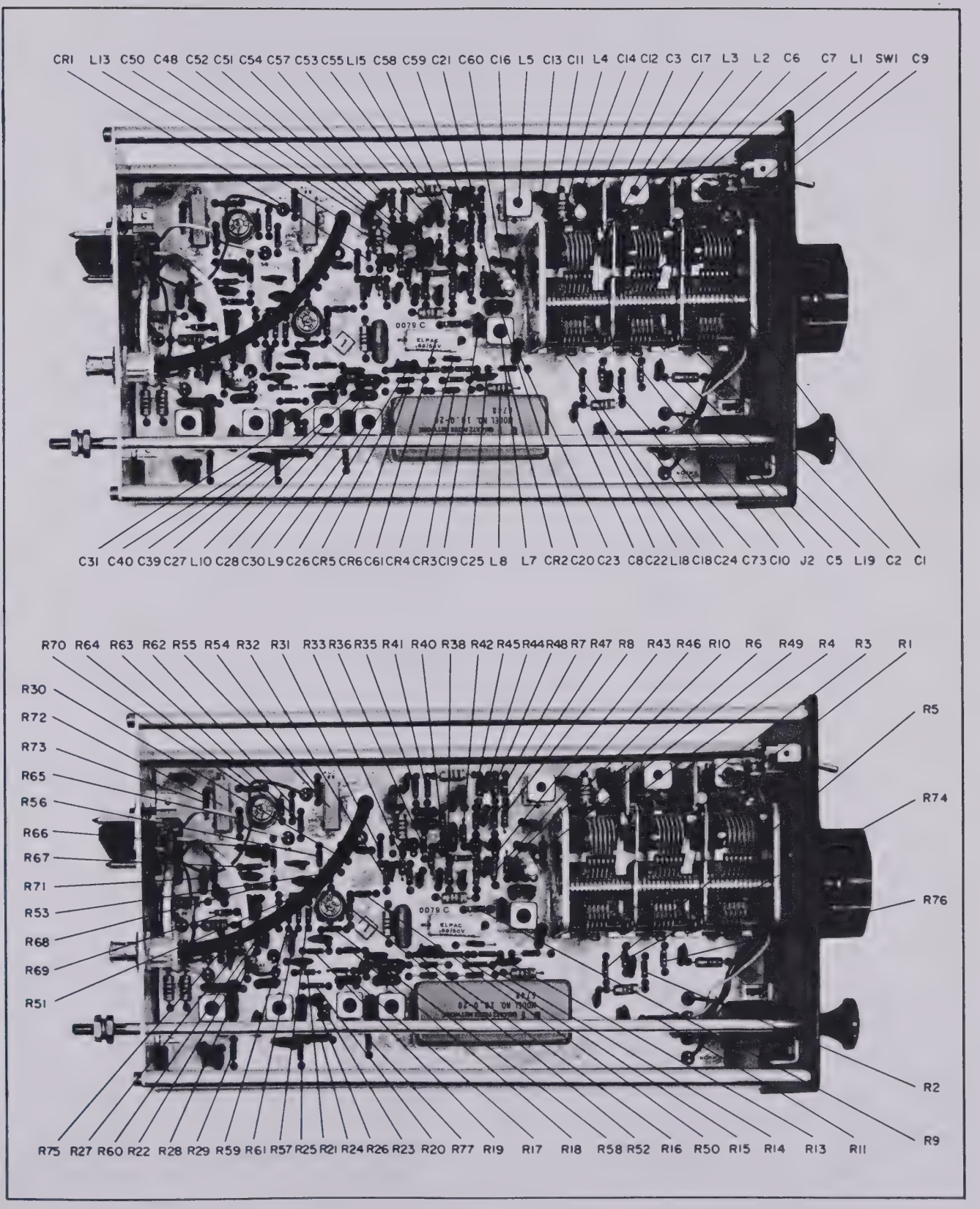


Figure 5-1. Model 304 Preselector, Parts Location (continued)

Printed Circuit Board 0079, 25-50 MHz Preselector

CKT. REF.	DESCRIPTION	C/E STOCK NO.	MFR.
	CAPACITORS		
C1	Air, variable, 3 section, 8-118 pF	1000-0005	TRW
C2	Trimmer, 2-12 pF part of C1		
C3	Cer, 0.002 μF ±20%, 600 V	1005-0003	Erie
C4	Cer, 0.002 μF ±20%,600V	1005-0003	Erie
C5	Cer, 0.002 μF±20%, 600V	1005-0003	Erie
C6	Cer, 0.002μF ±20% 600V	1005-0003	Erie
C7	Cer, 0.002μF ±20%, 600V	1005-0003	Erie
C8	Cer, 0.002μF ±20%, 600V	1005-0003	Erie
C9	Air, variable, 3 section, 8-118 pF	P/0 C1	
C10	Trimmer, 2-12 pF part of C1		
C11	Cer, 0.002μF ±20%, 600V	1005-0003	Erie
C12	Cer, 0.002μF ±20%, 600V	1005-0003	Erie
C13	Cer, 0.002μF ±20%, 600V	1005-0003	Erie
C14	Cer, 0.002 μF ±20%, 600V	1005-0003	Erie
C15	Cer, 0.05 μF+80% -20%, 25V	1005-0014	Erie
C16	Cer, 0.002 μF ±20%, 600V	1005-0003	Erie
C17	Air, variable, 3 section, 8-118 pF	P/0 C1	
C18	Trimmer, 2-12 pF part of C1		
C19	Cer, 0.05 μF +80% -20%, 25V	1005-0014	Erie
C20	Mica, 390 pF ±5%, 100V	1002-0033	Elmenco
C21	Cer, 0.05 μF +80%-20%, 25V	1005-0014	Erie
C22	Cer, 0.05 μF +80%-20%, 25V	1005-0014	Erie
C23	Cer, 0.05 μF +80 -%, 25V	1005-0014	Erie
C24	Cer, 0.05 μF +80%, 0.05 μF +80% -20%, 25V	1005-0014	Erie
C25	Cer, 0.05 μF +80% -20%, 25V	1005-0014	Erie
C26	Cer, 0.05 μF +80% -20%, 25V	1005-0014	Erie
C27	Mica, 820 pF ±5%, 100V	1002-0039	Elmenco
C28	Mica, 820 pF ±5%, 100V	1002-0039	Elmenco
C29	Cer, 0.05 μF +80% -20%, 25V	1005-0014	Erie
C30	Mica, 390pF ±5%, 100V	1002-0033	Elmenco
C31	Mica, 22pF ±5%, 100V	1002-0023	Elmenco
C32	Not Used		
C33	Cer, 0.05 μF +80% -20%, 25V	1005-0014	Erie
C34	Cer, 0.05 μF +80% -20%, 25V	1005-0014	Erie
C35	Cer, 0.05 μF +80% -20%, 25V	1005-0014	Erie
C36	Cer, 0.05 μF +80% -20%, 25V	1005-0014	Erie
C37	Mica, 390 pF ±5%, 100V	1002-0033	Elmenco
C38	Mica, 39 pF ±5%, 100V	1002-0018	Elmenco
C39	Cer, 0.05 μF +80% -20%, 25V	1005-0014	Erie
C40	Cer, 0.05 μF +80% -20%, 25V	1005-0014	Erie
C41	Cer, 0.05 μF +80% -20%, 25V	1005-0014	Erie
C42	Cer, 0.05 μF +80% -20%, 25V	1005-0014	Erie
C43	Mica, 33 pF ±5%, 100V	1002-0023	Elmenco
C44	Mica, 390 pF ±5%, 100V	1002-0033	Elmenco
C45	Cer, 0.002μF±20%, 600V	1005-0003	Erie

5.3 Schematics, Parts Lists and Pictorials

On the following pages schematics, parts lists and pictorials are grouped according to subassembly. Thus, schematic, parts list, and pictorial of a given PC board are found on adjacent pages.

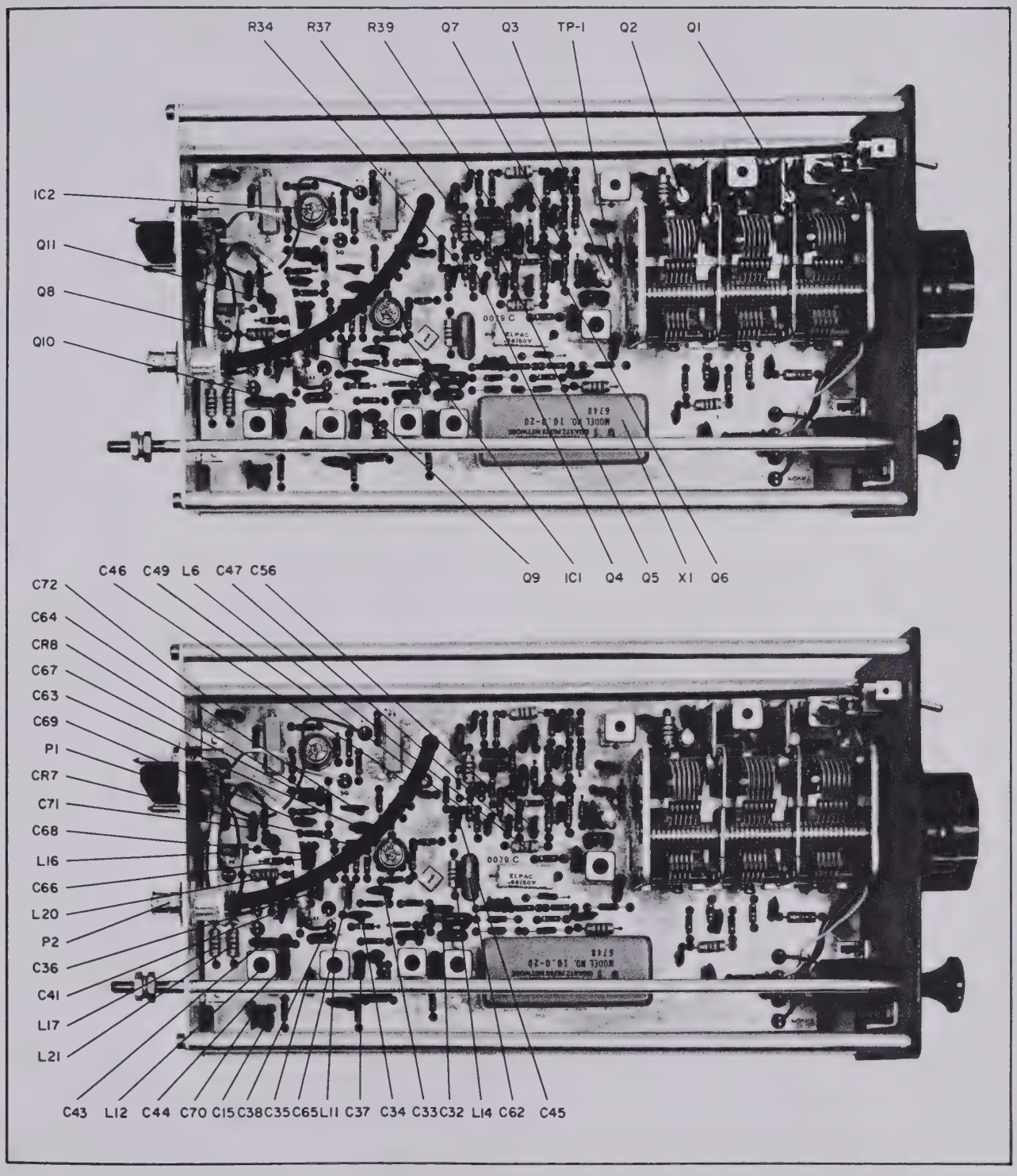


Figure 5-1. Model 304 Preselector, Parts Location

Printed Circuit Board 0079, 25-50 MHz Preselector (continued)

CKT. REF.	DESCRIPTION	C/E STOCK NO.	MFR.
	CAPACITORS (Continued)		
C46	Cer, 0.002 μF ±20%, 600V	1005-0003	Erie
C47	Cer, 0.002 μF ±20%, 600V	1005-0003	Erie
C48	Mica, 22 pF ±5%, 100V	1002-0023	Elmenco
C49	Cer, 0.002 μF ±20%, 600V	1005-0003	Erie
C50	Mica, 100 pF ±5%, 100V	1002-0011	Elmenco
C51	Mica, 100 pF ±5%, 100V	1002-0011	Elmenco
C52	Mica, 100 pF ±5%, 100V	1002-0011	Elmenco
C53	Cer, 0.002 μF ±20%, 600V	1005-0003	Erie
C54	Cer, 0.002 μF ±20%, 600 V	1005-0003	Erie
C55	Cer, 0.002μF ±20%,600V	1005-0003	Erie
C56	Cer, 0.002μF ±20%% 600V	1005-0003	Erie
C57	Cer, 0.002μF ±20%, 600V	1005-0003	Erie
C58	Cer, 0.002μF ±20%, 600V	1005-0003	Erie
C59	Cer, 0.002 μF±20%, 600V	1005-0003	Erie
C60	Cer, 0.002 μF ±20%, 600V	1005-0003	Erie
C61	Metalized Paper, 0.68 μF ±10%, 50V	1008-0039	El Pac
C62	Poly, 0.1 μF ±10%, 100V	1008-0031	Sprague
C63	Cer, 0.05 μF +80% -20%, 25V	1005-0014	Erie
C64	Cer, 0.05 μF +80% -20%, 25V	1005-0014	Erie
C65	Cer, 0.05 μF +80% -20%, 25V	1005-0014	Erie
C66	Cer, 0.05 μF +80% -20%, 25V	1005-0014	Erie
C67	Cer, 0.05 μF +80% -20%, 25V	1005-0014	Erie
C68	Cer, 0.05 μF +80% -20%, 25V	1005-0014	Erie
C69	Cer, 0.05 μF +80% -20%, 25V	1005-0014	Erie
C70	Cer, 0.05 μF +80% -20%, 25V	1005-0014	Erie
C71	Cer, 0.05 μF +80% -20%, 25V	1005-0014	Erie
C72	Cer, 0.05 μ F +80% -20%, 25V	1005-0014	Erie
C73	Cer, 0.002 μF ±20%, 600V	1005-0003	Erie
	DIODES		
CR1	Hot carrier, HPA2800	1238-0001	HPA
CR2	Si, 1N3064	1281-0013	Transitron
CR3	Si, 1N3064	1281-0013	Transitron
CR4	Si, 1N3064	1281-0013	Transitron
CR5	Si, 1N3064	1281-0013	Transitron
CR6	Si, 1N3064	1281-0013	Transitron
CR7	Ge, G633	1282-0005	ITT
CR8	Ge, G633	1282-0005	ITT
	INTEGRATED CIRCUITS		
IC1	RF Ampl, CA3028A	2025-0012	RCA
IC2	RF Ampl, CA3028A	2025-0012	RCA

Printed Circuit board 0079 25-50 MHz Preselector (continued)

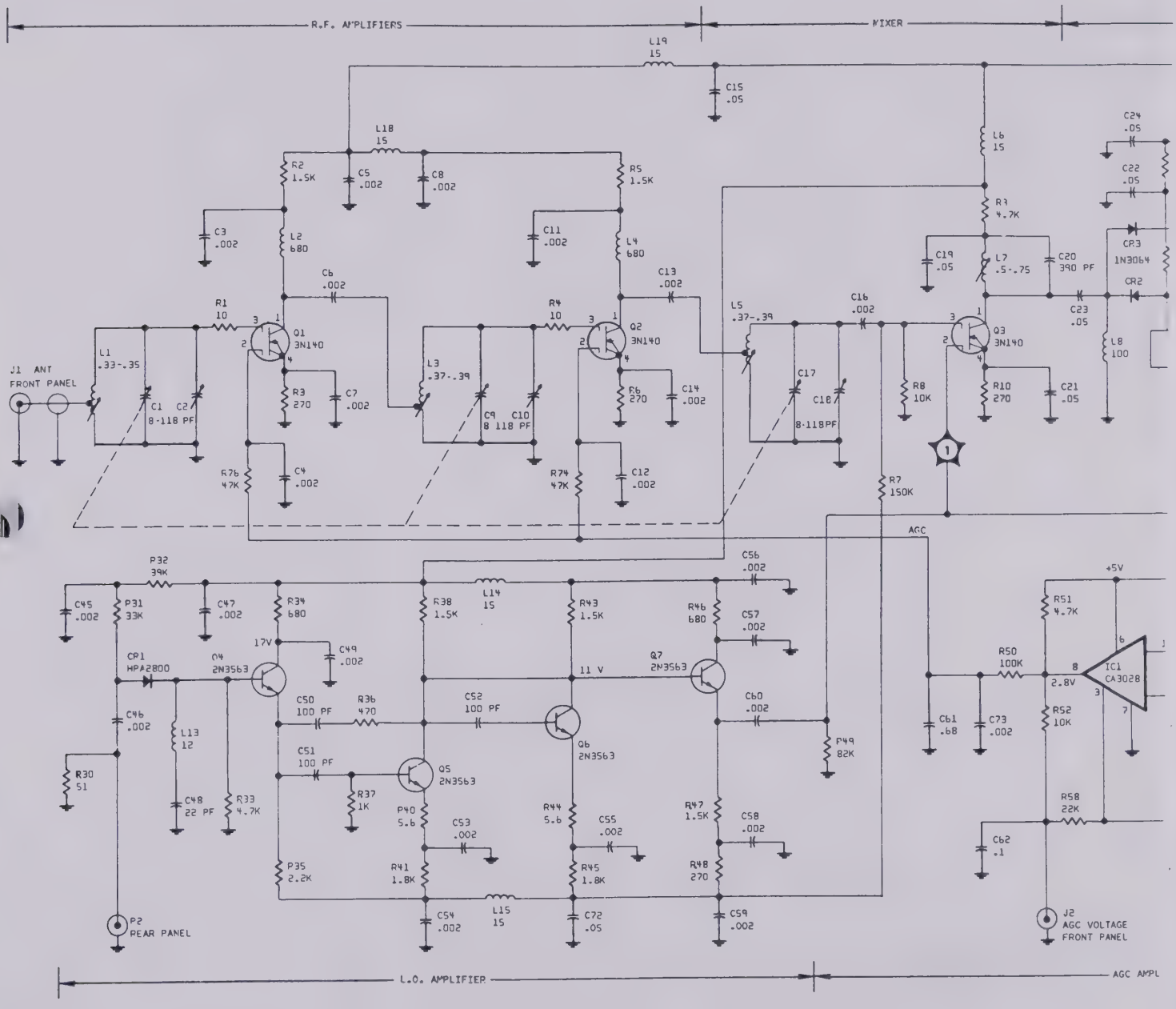
CKT. REF.	DESCRIPTION	C/E STOCK NO.	MFR.
	COILS		
L1	Var, 0.33-0.35 μH	7050-0023	Cushman
L2	RF Choke, 680 μH ±5%	1585-0023	Delevan
L3	Var, 0.37-0.39 μH	7050-0024	Cushman
L4	RF Choke, 680 μH ±5%	1585-0023	Delevan
L5	Var, 0.37-0.39 μH	7050-0024	Cushman
L6	RF Choke, 15 μH ±10%	1585-0034	Delevan
L7	Var, 0.5-0.75 μH	1596-0011	Cushman
L8	RF Choke, 100 μH ±5%	1585-0017	Delevan
L9	Var, 0.5-0.75 μH	1596-0011	Cushman
L10	Var, 0.5-0.75 μH	1596-0011	Cushman
L11	Var, 0.5-0.75 μH	1596-0011	Cushman
L12	Var, 0.5-0.75 μH	1596-0011	Cushman
L13	RF Choke, 12 μH±10%	1585-0011	Delevan
L14	RF Choke, 15 μH ±10%	1585-0034	Delevan
L15	RF CHOKE, 15 μH ±10%	1585-0034	Delevan
L16	RF Choke, 100 μH ±5%	1585-0017	Delevan
L17	RF Choke, 100 μH ±5%	1585-0017	Delevan
L18	RF Choke, 15 μH ±10%	1585-0034	Delevan
L19	RF Choke, 15 μH ±10%	1585-0034	Delevan
L20	RF Choke, 100 μH ±5%	1585-0017	Delevan
L21	RF Choke, 100 μ H ±5%	1585-0017	Delevan
	TRANSISTORS		
Q1	MOS/FET, Dual-Gate, N channel 3N140	1272-0028	RCA
Q2	MOS/FET, Dual-Gate, N channel 3N140	1272-0028	RCA
Q3	MOS/FET, Dual-Gate, N channel 3N140	1272-0028	RCA
Q4	Si, NPN, 2N3563	1272-0022	Fairchild
Q5	Si, NPN, 2N3563	1272-0022	Fairchild
Q6	Si, NPN, 2N3563	1272-0022	Fairchild
Q7	Si, NPN, 2N3563	1272-0022	Fairchild
Q8	Si, NPN, 2N3563	1272-0022	Fairchild
Q9	Si, NPN, 2N3563	1272-0022	Fairchild
Q10	Si, PNP, TIS37	1271-0003	T.I.
Q11	Si, PNP, 2N4121	1272-0023	Fairchild
	RESISTORS		
R1	Comp, 10 ohm ±5%, 1/4W	1066-1005	Allen-Bradley
R2	Comp, 1.5k ohm ±5%, 1/4W	1066-1525	Allen-Bradley
R3	Comp, 270 ohm ±5%, 1/4W	1066-2715	Allen-Bradley
R4	Comp, 10 ohm ±5%, 1/4W	1066-1005	Allen-Bradley
R5	Comp, 1.5k ohm ±5%, 1/4W	1066-1525	Allen-Bradley

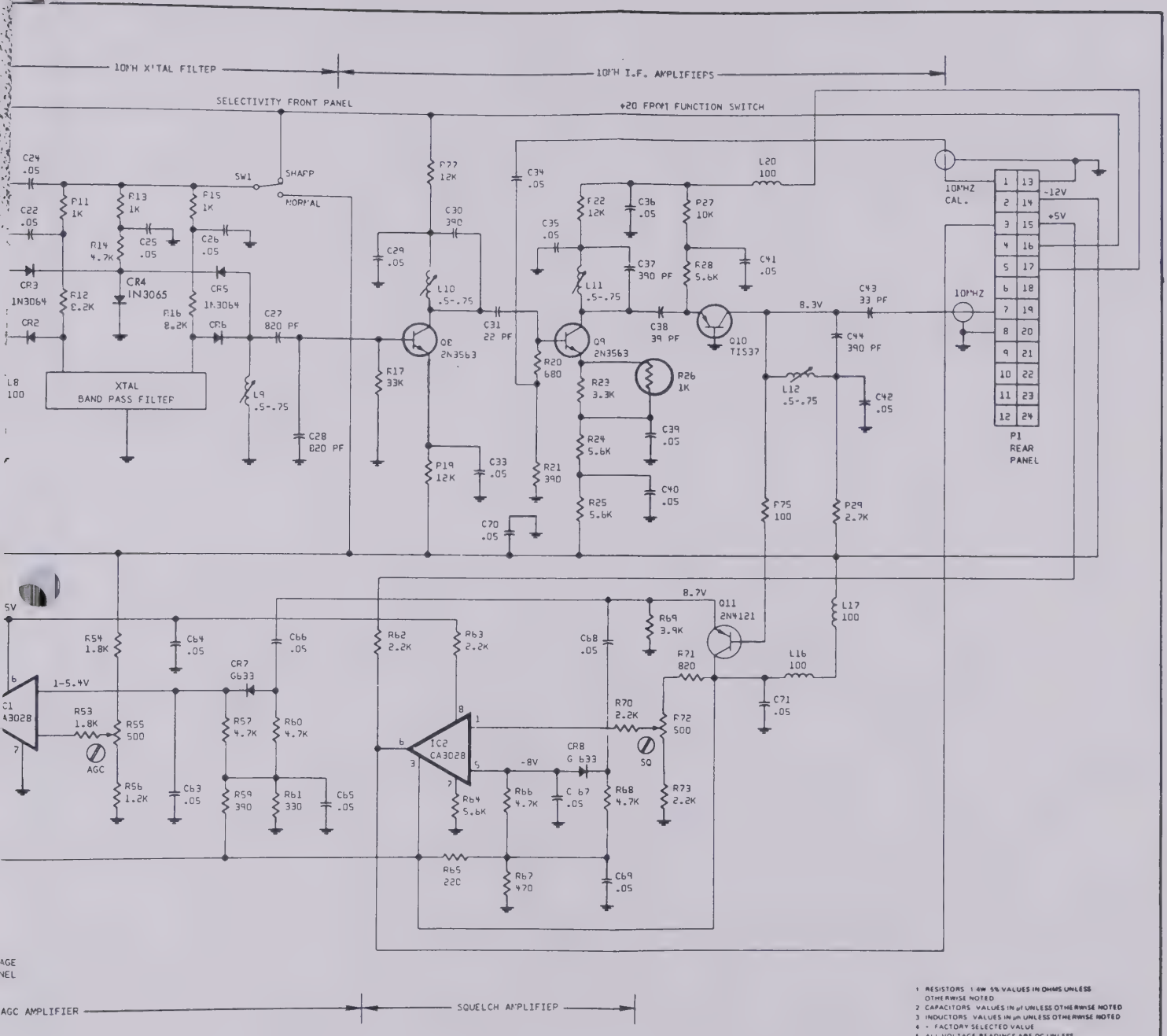
Printed Circuit Board 0079, 25-50 MHz Preselector (continued)

CKT. REF.	DESCRIPTION	C/E STOCK NO.	MFR.
	RESISTORS (Continued)		
R6	Comp, 270 ohm ±5%, 1/4W	1066-2715	Allen-Bradley
R7	Comp, 150k ohm ±5%, 1/4W	1066-1545	Allen-Bradley
R8	Comp, 10k ohm ±5%, 1/4W	1066-1035	Allen-Bradley
R9	Comp, 4.7k ohm ±5%, 1/4W	1066-1525	Allen-Bradley
R10	Comp, 270 ohm ±5%, 1/4W	1066-2715	Allen-Bradley
R11	Comp, 1k ohm ±5%, 1/4W	1066-1025	Allen-Bradley
R12	Comp, 8.2k ohm ±5%, 1/4W	1066-8225	Allen-Bradley
R13	Comp, 1k ohm ±5%, 1/4W	1066-1025	Allen-Bradley
R14	Comp, 4.7k ohm ±5%, 1/4W	1066-4725	Allen-Bradley
R15	Comp, 1k ohm ±5%, 1/4W	1066-1025	Allen-Bradley
R16	Comp, 8.2k ohm ±5%, 1/4W	1066-8225	Allen-Bradley
R17	Comp, 3.3k ohm ±5%, 1/4W	1066-3325	Allen-Bradley
R18	Not Used		
R19	Comp, 12k ohm ±5%, 1/4W	1066-1235	Allen-Bradley
R20	Comp, 680 ohm ±5%, 1/4W	1066-6815	Allen-Bradley
R21	Comp, 390 ohm ±5%, 1/4W	1066-3915	Allen-Bradley
R22	Comp, 12k ohm ±5%, 1/4W	1066-1235	Allen-Bradley
R23	Comp, 3.3k ohm ±5%, 1/4W	1066-3325	Allen-Bradley
R24	Comp, 5.6k ohm ±5%, 1/4W	1066-5625	Allen-Bradley
R25	Comp, 5.6k ohm ±5%, 1/4W	1066-5625	Allen-Bradley
R26	Thermistor, 1k ohm, 31E2	1253-0002	VECO
R27	Comp, 10k ohm ±5%, 1/4W	1066-1035	Allen-Bradley
R28	Comp, 5.6k ohm ±5%, 1/4W	1066-5625	Allen-Bradley
R29	Comp, 2.7k ohm ±5%, 1/4W	1066-2725	Allen-Bradley
R30	Comp, 51 ohm ±5%, 1/4W	1066-5105	Allen-Bradley
R31	Comp, 33k ohm ±5%, 1/4W	1066-3335	Allen-Bradley
R32	Comp, 39k ohm ±5%, 1/4W	1066-3935	Allen-Bradley
R33	Comp, 4.7k ohm ±5%, 1/4W	1066-4725	Allen-Bradley
R34	Comp, 680 ohm ±5%, 1/4W	1066-6815	Allen-Bradley
R35	Comp, 2.2k ohm ±5%, 1/4W	1066-2225	Allen-Bradley
R36	Comp, 470 ohm ±5%, 1/4W	1066-4715	Allen-Bradley
R37	Comp, 1k ohm ±5%, 1/4W	1066-1025	Allen-Bradley
R38	Comp, 1.5k ohm ±5%, 1/4W	1066-1525	Allen-Bradley
R39	Comp, 470 ohm ±5%, 1/4W	1066-4715	Allen-Bradley
R40	Comp, 5.6 ohm ±5%, 1/4W	1066-0003	Allen-Bradley
R41	Comp, 1.8k ohm ±5%, 1/4W	1066-1825	Allen-Bradley
R42	Comp, 1k ohm ±5%, 1/4W	1066-1025	Allen-Bradley
R43	Comp, 1.5k ohm ±5%, 1/4W	1066-1525	Allen-Bradley
R44	Comp, 5.6 ohm ±5%, 1/4W	1066-0003	Allen-Bradley
R45	Comp, 1.8k ohm ±5%, 1/4W	1066-1825	Allen-Bradley
R46	Comp, 680 ohm ±5%, 1/4W	1066-6815	Allen-Bradley
R47	Comp, 1.5k ohm ±5%, 1/4W	1066-1525	Allen-Bradley
R48	Comp, 270 ohm ±5%, 1/4W	1066-2715	Allen-Bradley
R49	Comp, 82k ohm ±5%, 1/4W	1066-8235	Allen-Bradley
R50	Comp, 100k ohm ±5%, 1/4W	1066-1045	Allen-Bradley

Printed Circuit Board 0079, 25-50 MHz Preselector (continued)

CKT. REF.	DESCRIPTION	C/E STOCK NO.	MFR.
	RESISTORS (Continued)		
R51	Comp, 4.7k ohm ±5%, 1/4W	1066-4725	Allen-Bradley
R52	Comp, 10k ohm ±5%, 1/4W	1066-1035	Allen-Bradley
R53	Comp, 1.8k ohm ±5%, 1/4W	1066-1825	Allen-Bradley
R54	Comp, 1.8k ohm ±5%, 1/4W	1066-1825	Allen-Bradley
R55	Pot., cer, metal, 500 ohm, 1/2W	1215-0002	Beckman
R56	Comp, 1.2k ohm ±5%, 1/4W	1066-1225	Allen-Bradley
R57	Comp, 4.7k ohm ±5%, 1/4W	1066-4725	Allen-Bradley
R58	Comp, 22k ohm ±5%, 1/4W	1066-2235	Allen-Bradley
R59	Comp, 390 ohm ±5%, 1/4W	1066-3915	Allen-Bradley
R60	Comp, 4.7k ohm ±5%, 1/4W	1066-4725	Allen-Bradley
R61	Comp, 330 ohm ±5%, 1/4W	1066-3315	Allen-Bradley
R62	Comp, 2.2k ohm ±5%, 1/4W	1066-2225	Allen-Bradley
R63	Comp, 2.2k ohm ±5%, 1/4W	1066-2225	Allen-Bradley
R64	Comp, 5.6k ohm ±5%, 1/4W	1066-5625	Allen-Bradley
R65	Comp, 220 ohm ±5%, 1/4W	1066-2215	Allen-Bradley
R66	Comp, 4.7k ohm ±5%, 1/4W	1066-4725	Allen-Bradley
R67	Comp, 470 ohm ±5%, 1/4W	1066-4715	Allen-Bradley
R68	Comp, 4.7k ohm ±5%, 1/4W	1066-4725	Allen-Bradley
R69	Comp, 3.9k ohm ±5%, 1/4W	1066-3925	Allen-Bradley
R70	Comp, 2.2k ohm ±5%, 1/4W	1066-2225	Allen-Bradley
R71	Comp, 820 ±5%, 1/4W	1066-8215	Allen-Bradley
R72	Pot., cer, metal, 500 ohm, 1/2W	1215-0002	Beckman
R73	Comp, 2.2k ohm ±5%, 1/4W	1066-2225	Allen-Bradley
R74	Comp, 47k ohm ±5%, 1/4W	1066-4735	Allen-Bradley
R75	Comp, 100 ohm ±5%, 1/4W	1066-1015	Allen-Bradley
R76	Comp, 47k ohm ±5%, 1/4W	1066-4735	Allen-Bradley
R77	Comp, 12k ohm ±5%, 1/4W	1066-1235	Allen-Bradley
	CRYSTALS		
X1	Xtal, band pass filter	1040-0012	Cushman
	SWITCHES		
SW1	SPDT No. 7101	1850-0008	C & K
	PLUGS		
P1	Male, 24 Pin No. 26-159-24	2535-0019	Amphenol
P2	Male, Coax no. 5088	2536-0013	Star
	JACKS		
J1	Female, Coax No. 83-875	2536-0017	Amphenol
J2	Female, Phone no. 12-13	2586-0006	Switchcraft


R.F. AMPLIFIERS
MIXER
L.O. AMPLIFIER
AGC AMPL
J1 ANT FRONT PANEL
L1 .33-.35
C1 C2 8-118 PF
Q1 3N140
Q2 3N140
Q3 3N140
L2 680
L3 .37-.39
L4 680
L5 .37-.39
L6 15
L7 .5-.75
L8 100
L18 15
L19 15
C3 .002
C4 .002
C5 .002
C6 .002
C7 .002
C8 .002
C9 C10 8 118 PF
C11 .002
C12 .002
C13 .002
C14 .002
C15 .05
C16 .002
C17 C18 8-118PF
C19 .05
C20 390 PF
C21 .05
C22 .05
C23 .05
C24 .05
R1 10
R2 1.5K
R3 270
R4 10
R5 1.5K
R6 270
R7 150K
R8 10K
R9 4.7K
R10 270
R76 47K
R74 47K
AGC
P32 39K
P31 33K
C45 .002
C47 .002
R34 680
17V
C49 .002
CR1 HP#2800
Q4 2N3563
C46 .002
L13 12
R30 51
C48 22 PF
R33 4.7K
C50 100 PF
R36 470
C51 100 PF
R37 1K
Q5 2N3563
P35 2.2K
P40 5.6
R41 1.8K
C53 .002
C54 .002
L14 15
L15 15
R38 1.5K
R43 1.5K
R44 5.6
R45 1.8K
C55 .002
C72 .05
C56 .002
R46 680
C57 .002
11 V
Q7 2N3563
Q6 2N3563
C52 100 PF
C60 .002
P49 82K
R47 1.5K
R48 270
C58 .002
C59 .002
P2 REAR PANEL
+5V
R51 4.7K
R50 100K
IC1 CA3028
2.8V
R52 10K
C61 .68
C73 .002
R58 22K
C62 .1
J2 AGC VOLTAGE FRONT PANEL



1. RESISTORS 1/4W 5% VALUES IN OHMS UNLESS OTHERWISE NOTED
2. CAPACITORS VALUES IN μf UNLESS OTHERWISE NOTED
3. INDUCTORS VALUES IN μh UNLESS OTHERWISE NOTED
4. * FACTORY SELECTED VALUE
5. ALL VOLTAGE READINGS ARE DC UNLESS OTHERWISE NOTED

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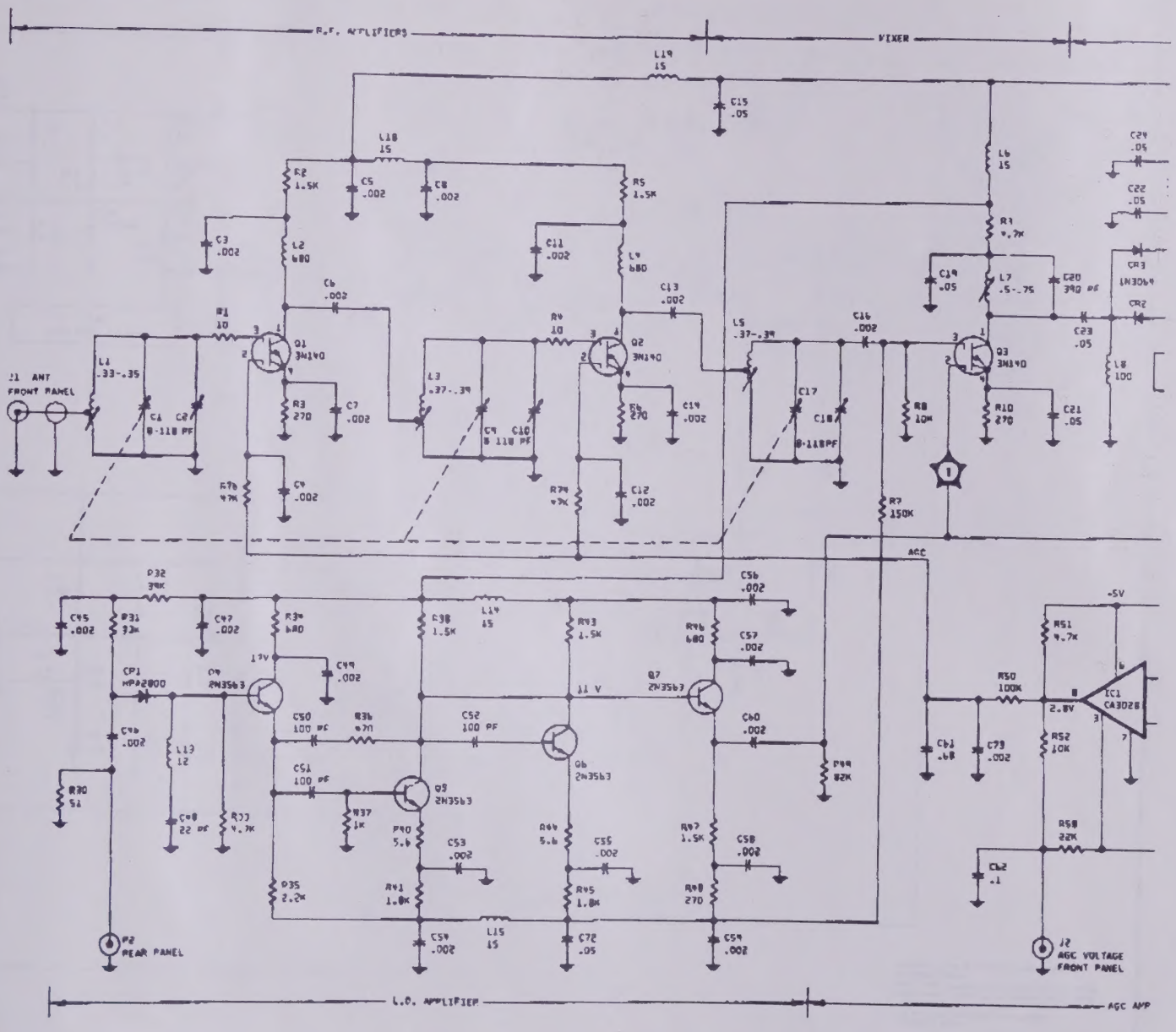
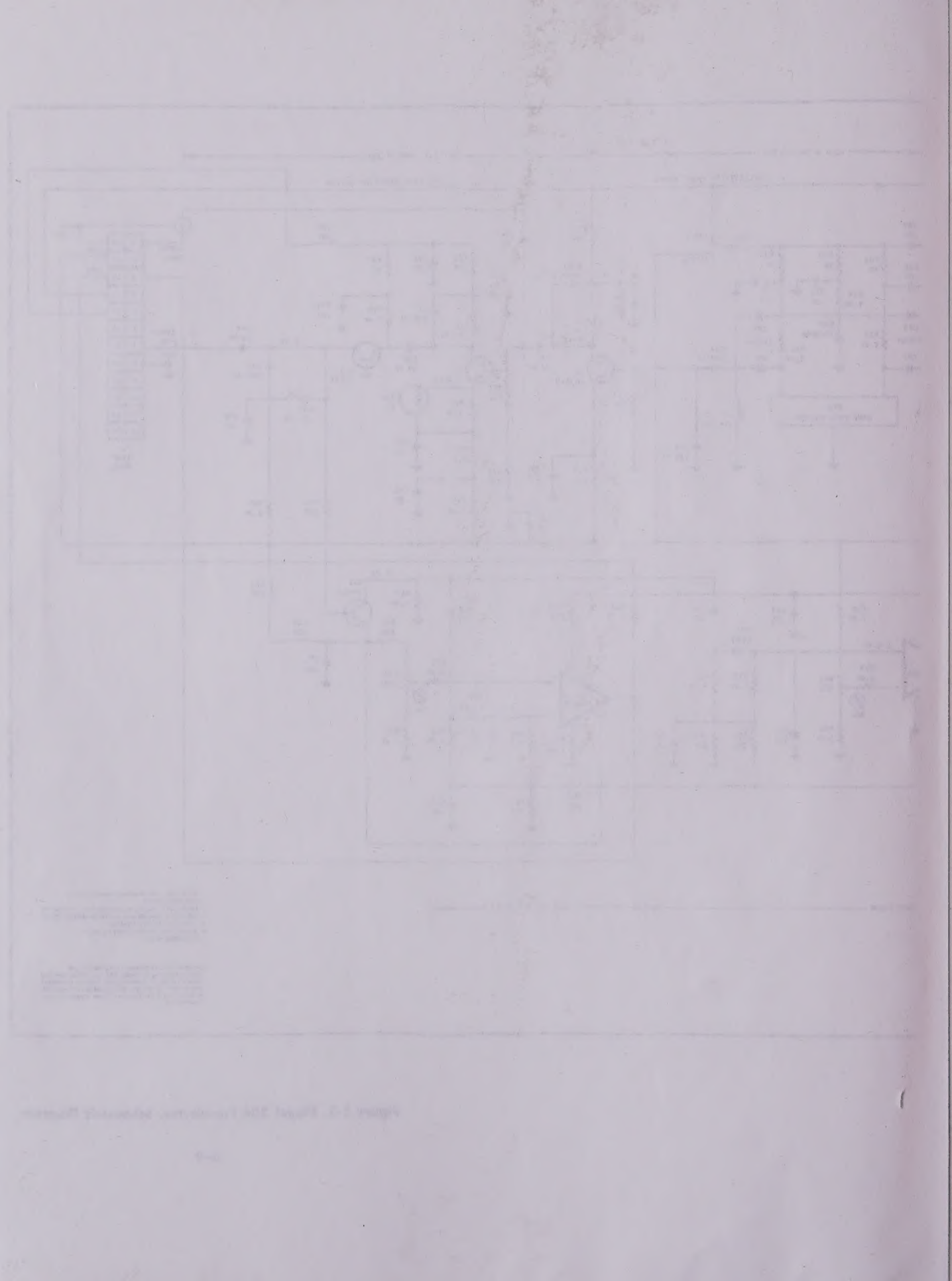
Figure 5-2. Model 304 Preselector, Schematic Diagram


R.F. AMPLIFIERS
MIXER
J1 ANT FRONT PANEL
Q1 3N140
Q2 3N140
Q3 3N140
Q4 2N3563
Q5 2N3563
Q6 2N3563
Q7 2N3563
CR1 MPA2800
CR2
CR3 1N3064
AGC
+5V
IC1 CA3028
J2 AGC VOLTAGE FRONT PANEL
P2 REAR PANEL
L.O. AMPLIFIER
AGC AMP

5601-0011-1



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ILLINOIS 60090
25978
MADE IN USA
0 50505 25978 6
RED/ROUGE/ROJO

MP MASTER
MA31750